

26425 - Geotechnics and Geophysical Prospecting

Información del Plan Docente

Academic Year	2017/18
Faculty / School	100 - Facultad de Ciencias
Degree	296 - Degree in Geology
ECTS	7.0
Year	4
Semester	First semester
Subject Type	Compulsory
Module	---

1.General information

1.1.Introduction

Brief intro to the course

Geotechnics is the application of scientific methods and engineering principles to the acquisition, interpretation, and use of knowledge of materials of the Earth's crust and earth materials for the solution of engineering problems and the design of engineering works. It is the applied science of predicting the behaviour of the Earth, its various materials and processes towards making the Earth more suitable for human activities and development.

Geotechnics embraces the fields of soil mechanics and rock mechanics, and many of the aspects of geology, geophysics, hydrology, and other related sciences.

Geophysical survey is the systematic collection of geophysical data for spatial studies. Detection and analysis of the geophysical signals form the core of Geophysical signal processing. Geophysical surveys may use a great variety of sensing instruments. Geophysical surveys are used in industry as well as in scientific research, though in this course we will focus in those methods of common application in geotechnical and civil engineering studies.

1.2.Recommendations to take this course

This course is among the courses devoted to those applied aspects of Geology. It requires some familiarity with solving numerical problems, as usual in Physics or Mathematics, and the ability to integrate the studied topics within the wider scope of matters learned in other courses. It is recommended to have successfully passed courses on physics and structural geology in previous years. It is recommended, as well, to assist to all lectures and the rest of activities, to keep a daily routine of work in order to fulfil the deadlines for papers and questionnaires, and to make use of tutorial times.

1.3.Context and importance of this course in the degree

This course is usually undertaken in the fourth year of the degree. Therefore, the students are expected to already have wide geological knowledge, and to be skilled at using the necessary tools -both physical and conceptual- usually fielded in geology.

1.4.Activities and key dates

26425 - Geotechnics and Geophysical Prospecting

The course consists of lectures, laboratory exercises, one-morning of field work with geophysical instruments, and one-morning of geotechnical lab visit.

Key dates:

First official week: kick off of the lectures

Second official week: first practical

Tests period: to be determine by the faculty

Teachers

Luis Arlegui Crespo. Área de Geodinámica Interna. Dpto. de Ciencias de la Tierra. Available for tutorials on Monday to thursday, 12 -13 h and Tuesday and Wednesday 10 -11 h

Andrés Pocoví Juan. Área de Geodinámica Interna. Dpto. de Ciencias de la Tierra. Lunes a jueves de 13 -14 h y Martes y Miércoles de 9-10 h

2.Learning goals

2.1.Learning goals

To successfully pass this course the student will achieve to...

Fundamentals of Soil Mechanics

... know concepts and basic terminology.

... know and apply the Unified Soil Classification System.

... know how to calculate stress by the self weight of soil: effective stress, total stress, and pore water pressure.

... know how to calculate the underground increase in stress due to surface loading.

... know and use the concept of normally consolidated and overconsolidated soils.

... know and use the Mohr Circle and the failure law of Mohr-Coulomb for the shear strength of soils.

... understand the workings and goals of the different failure tests.

26425 - Geotechnics and Geophysical Prospecting

... appreciate the importance of detecting trouble soils, and to integrate other geological sciences into geotechnics.

Fundamentals of Rock Mechanics

... know the difference between rock matrix and rock mass and its implications.

... know the main failure criteria for rock matrix and rocks masses.

... know how to characterise a rock mass.

Applications of Soil Mechanics

... know the different kind of foundations.

... know how to calculate bearing capacity of soils.

... know how to estimate settlement and time of settlement.

... know how to plan and perform the geotechnical report for a construction site.

... know how slopes fail, and how to calculate their stability.

Methods and Applications of Geophysical Surveying

... know the physical fundamentals of the main methods.

... know their applications and drawbacks.

2.2.Importance of learning goals

3.Aims of the course and competences

3.1.Aims of the course

In this course the main objectives are that the prospective student acquires a series of professional competencies in the field of Geotechnics, with appreciation of the importance of geology in civil engineering, whilst embracing the ethical compromise of a fully fledged professional geologist. After successfully completing the course the student will be able to collect data and samples, order tests and perform calculations in for building foundations, slope stability analysis etc. The student will be able to distinguish the applications and drawbacks of several methods of geophysical proving.

3.2. Competences

Upon completion of this course, students will be able to:

- solve usual problems in geotechnics.
- know the main methods of geophysical surveying.

4. Assessment (1st and 2nd call)

4.1. Assessment tasks (description of tasks, marking system and assessment criteria)

Assessment activities

Continuous evaluation

1. Questionnaires (running test): at the end of each lecture the student must answer one or more questions related to the topic at hand.
2. Practicals: Each practical session includes additional problems that must be solved and presented before the next session.
3. Written test. Near the end of the term there will be a test (4-5h long) with question and/or problems to evaluate the understanding of the course. The student may consult books, course notes, etc.

Global Evaluation test

Students that failed to follow the course, and those that wish to, have the right to a global evaluation test. It consist on a written test, alike the previously described, and an it may include additional test where the student will show his/her skills with geophysical instruments.

Assessment criteria or Course Grade Distribution

1. Continuous evaluation mode: $\text{grade} = (\text{test} \times 0.7) + (\text{continuous ev.} \times 0.3)$, where "continuous ev." referees to (classroom questions + additional problems) $\times 0.5$.
2. Global test.

5. Methodology, learning tasks, syllabus and resources

5.1. Methodological overview

This module consists of lectures, practical laboratories, tutorial exercises, may include case histories and coursework exercises.

5.2.Learning tasks

Activity 1 . Learning of concepts, descriptions and calculations bases.

Lectures (2.8 ECTS)

Coursework (0.4 ECTS)

Tutorials and seminars (0,5 ECTS)

Activity 2. Learning of procedures and tools

External visit to a professional lab (0.8 ECTS)

Practicals: interpreting geophysics (0,2 ECTS)

Field work (0,3 ECTS)

Practicals: solving numerical problems in geotechnics (2 ECTS)

5.3.Syllabus

Course syllabus

Unit 1. Fundamentals of soil mechanics

T1. Soil properties and classification

T2. Soil stress: self weight and induced stress by loading

T3. Soil consolidation.

T4. Conditions of failure. Soil shear and failure.

Unit 2. Fundamentals of rock mechanics

T5. Rock and rock mass. Conditions of failure.

T6. Characterisation and classification of rock masses

Unit 3. Applied geotechnics

T7. Bearing capacity of soil

T8. Deep foundations

T9. Geotechnic surveying and report

T10. Soil slopes

T11. Rock slopes

T12. Lateral earth pressure

Unit 4. Geophysical surveying

T13. Electrical methods

T14. Seismic refraction

T15. Ground Probing Radar

5.4.Course planning and calendar

5.5.Bibliography and recommended resources

BB	Azizi, Fethi. Applied analyses in geotechnics / Fethi Azizi . London ; New York : Taylor & Francis, 2000
BB	Bowles, Joseph E.. Propiedades geofísicas de los suelos / Joseph E. Bowles ; traducción Eugenio Retamal, Hugo Cosme ; revisión Luciano Rivera Bogotá [etc.] : McGraw-Hill, cop. 1982
BB	España. Ministerio de la Vivienda. Código Técnico de la Edificación (CTE) : Real Decreto 314 /2006, de 17 de marzo por el que se aprueba el Código Técnico de la Edificación / Ministerio de Vivienda. 1ª ed.

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Madrid : Boletín Oficial del Estado :
Ministerio de Vivienda, 2006 [Libro 3:
Seguridad Estructural: Cimientos]

BB Geotécnia y cimientos. V. 1, Propiedades
de los suelos y de las rocas / J.A. Jiménez
Salas, J.L. de Justo Alpañes . - 2a. ed.
Madrid : Rueda, D.L. 1975

BB Geotécnia y cimientos. V. 2, Mecánica del
suelo y de las rocas / J.A. Jiménez Salas,
J.L. de Justo Alpañes, Alcibiades A.
Serrano González . - 2a ed Madrid :
Rueda, D.L. 1981

BB Geotécnia y cimientos. V. 3,
Cimentaciones, excavaciones y
aplicaciones de la geotecnia / coordinador
y director edición, José Antonio Jiménez
Salas ; Luis del Cañizo Perate...[et al.]
Madrid : Rueda, D.L. 1980

BB Ingeniería geológica / Luis I. González de
Vallejo...[et al.] Madrid [etc.] : Prentice Hall,
2006

BB Lambe, T. William. Mecánica de suelos / T.
William Lambe, Robert V. Whitman ;
[versión española José A. Jiménez Salas,
Jose Ma. Rodriguez Ortiz ; revisión
Alfonso Rico Rodríguez] . - [8a. reimp.]
Mexico [etc.] : Limusa, 1991

BB Manual de campo para la descripción y
caracterización de macizos rocosos en
afloramientos / [editores, Mercedes Ferrer,
Luis I. González de Vallejo] . Madrid :
Instituto Tecnológico GeoMinero de
España, 2007

LISTADO DE URLs:

Guía de cimentaciones en obras de
carretera. Serie Monografías. Dirección
Técnica de la Dirección General de
Carreteras -
[<http://www.fomento.es/NR/rdonlyres/63A5CC1B-E7B9-4638-AE45-8BA22A5802>]

26425 - Geotechnics and Geophysical Prospecting

Rock engineering. Course notes by Evert

Hoek -

[http://www.rocscience.com/hoek/corner/Practical_Rock_Engineering.pdf]

Soil mechanics -

[http://www.geotech.pe.kr/zeroboard/data/Geo_Bank/SoilMechBook.pdf]